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ABSTRACT

A study was conducted to test the hypothesis that spontaneous mastery would predict infant functioning on the Bayley Mental Development Index better than would infants' executive capacity scores. At 12 and 18 months of age, 38 infants (20 from Pennsylvania and 18 from Bermuda) were observed for 30 minutes in their homes while engaging in spontaneous play with two sets of toys. Each child's most sophisticated play act was coded by the observer on a 12-step play scale. (The 12-step play scale reflects the progression of play behaviors from the infants' early explorations and object groupings to their later emerging pretend acts directed at both self and others, their substitution of objects, and their use of sequenced acts in pretense.) To measure infants' executive capacities, the same observer encouraged the child to engage in play more sophisticated than that which was displayed during free play. The child's executive capacity scores were then established as the difference between spontaneous and elicited play. Infants' mastery persistence scores were calculated by weighting the frequency of spontaneous play activity according to the play level in which it occurred. Results provided support for the study's hypothesis. (MP)

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What are we testing? A cross-cultural comparison of infant competence [1]

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Introduction

Learning difficulties associated with disadvantaged children may often be due to lacking motivational competencies rather than cognitive insufficiencies (Scarr, 1981). The idea of motivational competence is not new. Effectance motivation, goal directedness, and persistence with tasks are well known conceptions to students of motivation (White, 1959; Harter & Zigler, 1974). Even so the distinction between mastery motivation and competence is not always clear (Yarrow, et. al, 1983) and the interrelatedness of these constructs is often ignored in testing and educating children. As test examiners and educators we tend to focus on the child's cognitive functioning and may neglect the importance of cooperation, attention, persistence, ability to sit still, and social responsiveness within the assessment situation. Yet, these very characteristics often govern whether or not the child will excel in school.

The standardized infant assessment measure is an example of our limited focus on cognition and lack of attention to the influence of motivational variables (Hrncir & Belsky, Note 1). During the standardized testing situation children are not allowed to initiate responses, children do not decide whether or not they will attend, persist, and essentially lose themselves in the tasks. Instead, the tasks are defined for children, children's attention is repeatedly focussed, and children are praised and encouraged regarding their performance. In so doing the test examiner eliminates variance that might exist in children's own motivation to deploy their capabilities.

We suggest that children's own motivation to deploy their capabilities, coined spontaneous mastery for this study, can be measured in spontaneous play. Our spontaneous mastery measure samples both level of play acts and each act exhibited and therefore is a more comprehensive measure than Yarrow and Associates (1983) mastery motivation measure or Belsky, Garduque and Hrncir's (Note 2) executive capacity measure.[2] Yarrow and associates, in examining mastery motivation, consider all play acts and do not take into consideration the sophistication of each play act. Belsky, Garduque and Hrncir (Note 2), on the other hand, examine only the highest level of free play and highest level of elicited play. Highest level behaviours are a small sample of the entire spectrum of a child's play.

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[1] Paper presented at the biennial meeting of the Society for Research in Child Development, Detroit, Michigan, April, 1983.

[2] Belsky, Garduque and Hrncir (in press) suggest that the infant's executive capacity or the infant's ability to execute in a self-initiated manner his/her most advanced level of functioning can be measured as the discrepancy between the infant's highest spontaneous level of play and highest elicited level of play (the less motivated the child on his/her own the higher the discrepancy score).

We hypothesized that spontaneous mastery would reliably predict infant functioning on the Bayley MDI at 12 and 18 months better than infants' executive capacity scores. These predictions are based on the belief that a reciprocal relationship exists between infants' spontaneous mastery and their developmental competence, as measured by the Bayley MDI. Consequently children who were more proficient at mastering tasks on their own, as measured in spontaneous play were expected to do better when motivated by an adult to succeed in the testing situation (i.e. Bayley MDI). Since the spontaneous mastery measure taps the entire spectrum of the child's play taking into account both sophistication of play and each act demonstrated, we hypothesized it would be a better predictor of infant functioning on the Bayley MDI than the executive capacity measure.

Procedure

In order to examine the relationships of spontaneous mastery and executive capacity to cognitive ability and in order to determine the predictive value of these constructs over time, infants' spontaneous and elicited play and cognitive functioning on the Bayley Mental Scales test was examined at 12 and 18 months of age. Belsky, Garduque, and Hrncir's (Note 2) recent study lent construct validity for measuring executive capacity as the discrepancy between the child's highest spontaneous level of play and the child's highest elicited level of play. Mastery persistence was calculated by weighting the number of play acts according to level of sophistication on the play scale.

Twenty infants, ten males and ten females were visited in their homes in Pennsylvania at 12 and 18 months. Eighteen infants, nine males and nine females were visited in their homes in Bermuda at 12 and 18 months.

The thirty-eight infants were observed in spontaneous play with two sets of toys, for a maximum of thirty minutes at 12 and 18 months. (Toy Set 1: 4 coloured sticks, 2 plastic donuts, 1 Fisher-Price Queen Buzybee, 1 toy telephone, 1 plastic rectangle with a hole in the middle, 1 plastic triangle with a hole in the middle, and a flat bed cart on wheels with 4 spools that sit on top of the shafts which are mounted on the cart; Toy Set II miniature doll, big doll, miniature bed, irregular shaped pieces of foam rubber and green felt, rectangular wooden block, wooden stick miniature hairbrush, toy telephone, sea-shell, toy baby bottle and a miniature car). After the play period of each occasion (i.e. 12 and 18 months) the observer scored the infant's most sophisticated play act on the 12-step play scale shown to form a uni-dimensional and cumulative Guttman scale sensitive to ontogenetic change (Belsky & Most, 1981). The 12-step play scale reflects the progression of play behaviours from the infants' early exploration, and object groupings (e.g. Zelazo & Kearsley, 1980; Fenson et. al, 1976; Belsky & Most, 1981; and Largo & Howard, 1979) to the infant's later emerging pretend acts directed at both self and others, substitution of objects and use of sequenced acts in pretence (e.g. Watson & Fisher, 1977, 1980; Fein, 1975).

Executive Capacity. This same observer then encouraged the child via verbal suggestion and modeling to engage in play more sophisticated than that which she/he displayed during free play by progressing one step at a time along a modified version of the 12-step play scale. Executive capacity scores were calculated as the difference between spontaneous and elicited play.

Persistence Mastery. Coders marked down the highest step behaviour demonstrated by the child in spontaneous play for each twenty second time sampling period. Mastery persistence scores were calculated by weighting the frequency of spontaneous play activity according to the play level in which it occurred. Thus if a child performed five acts at level 3 and two acts at level 4 and no other acts, spontaneous mastery would equal (15 x 3) + (2 x 4) = 23. Such procedure was justified by the fact that the play scale forms a Guttman scale and by the fact that all children had the same pro-rated total frequency scores.

Bayley MDI. Each child was assessed on the Bayley MDI within a week of the play assessment at 12 and 18 months.

Results

When measures of spontaneous mastery and executive capacity at 12 months were correlated with Bayley MDI at 12 and 18 months: (see Table 1)

1. A moderately high relationship was found between spontaneous mastery at 12 months and Bayley MDI at 12 months ($r = .54$, $p = .001$).

2. A similar relationship was found between spontaneous mastery at 12 months and Bayley MDI at 18 months ($r = .48$, $p = .001$).

3. A significant negative relationship was found between executive capacity at 12 months and Bayley MDI at 12 months ($r = -.31$, $p = .05$).

4. A negative but not significant relationship was found between executive capacity at 12 months and Bayley MDI at 18 months ($r = -.23$).

As expected, when Bayley MDI scores at 12 months were correlated with Bayley MDI scores at 18 months a high significant relationship was found ($r = .50$, $p = .001$).

In order to consider the possibility that the relationship between measures may not be unidirectional, spontaneous mastery and executive capacity at 18 months were correlated with Bayley MDI at 12 and 18 months. The findings give some support to a bidirectional relationship: (see Table 1)

1. A significant relationship was found between spontaneous mastery at 18 months and Bayley MDI at 12 months ($r = .31$, $p = .05$).

2. Likewise spontaneous mastery at 18 months was related to Bayley MDI at 18 months ($r = .45$, $p = .01$).

The 12 play categories were combined to form three summary variables, undifferentiated play, transitional play and pretend play, as based on developmental trends found in infant play in recent studies. Then these summary variables were used in the t - test analyses. To determine whether or not differences existed between the Pennsylvania and Bermuda sample and whether or not any differences existed in the earlier sample, t - tests were run on measures of spontaneous mastery, executive capacity, Bayley MDI, undifferentiated play, transitional play, and pretend play at 12 and at 18 months.

The Pennsylvania and Bermuda samples differed on measures of executive capacity ($F\ 1, 36 = 8.09$, $p < .01$), undifferentiated play ($F\ 1, 36 = 4.80$) $p < .05$), and transitional play ($F\ 1, 36 = 4.32$, $p < .05$) at 12 months of age. The Bermuda children on the whole were less likely to display less sophisticated play acts such as exploration of objects and grouping of objects and more likely to display more sophisticated play acts such as pretend directed at both self and others, substitution of objects, and use of sequenced acts in pretend than were the Pennsylvania children at 12 months of age. Also the Bermuda children in general had lower executive capacity scores at 12 months, therefore displaying a smaller gap between their most sophisticated play exhibited in free and elicited play. This trend in differences for executive capacity, undifferentiated play, and transitional play scores was not observed in the 18 month samples. Therefore it is difficult to draw any culturally relevant conclusion from the 12 month data alone. There were no sex differences on any of the measures at 12 or 18 months.

Conclusions

The finding that spontaneous mastery or the tendency for play acts to be distributed higher or lower along a level of sophistication of the play scale, reliably predicted infants' performance on the Bayley MDI at the same age and six months later suggests an intriguing relationship between infants' mastery of tasks on their own and adjustment to learning environments. Such findings are in line with those of Yarrow and associates (1983) suggesting that children's mastery of tasks on their own may be as sensitive a predictor of developmental competence as standardized tests such as the Bayley MDI. Support for the predictability of the spontaneous mastery measure is also gained from a series of studies showing similar process variables in infancy as better predictors of later cognitive functioning than scores on standardized infant measures (Lewis, Goldberg & Campbell, 1969; Miranda & Fantz, 1974). The present study contributes another dimension to the study of the interrelatedness of motivation and competence by suggesting that the distribution and sophistication of the child's spontaneous play acts may at least partially determine how well she/he will do in the standardized testing situation.

As hypothesized the overall measure of spontaneous mastery was a better predictor of Bayley MDI functioning than the measure of executive capacity. The negative significant relationship between executive capacity at 12 months and the Bayley MDI at 12 months, and the remaining non-significant negative relationships of this measure with the Bayley are theoretically interesting. Recall that executive capacity is determined as the discrepancy between spontaneous and elicited play as based on the theoretical conception that the greater the discrepancy, the less motivated the child was in play on his or her own. The executive capacity score takes into account the peak occurrence of the most sophisticated play acts while not considering the entire spectrum of the child's play. Perhaps it is the sophistication within the entire spectrum of play that is indicative of developmental competence.

Our findings shed light on the reciprocal interaction between infants' spontaneous mastery of play acts and their developmental competence as measured by the Bayley MDI, and support the view of Yarrow and associates (1983) that competence is necessary for mastery and mastery is necessary for competence. Over time the interrelatedness of mastery and competence may, indeed influence the learning histories of children. That is, children who master tasks on their own may also be more inclined to evoke stimulation from parents, teachers and peers, and therefore may be exposed to the "better" environments.

Table 1

Correlations between Spontaneous Mastery, Executive Capacity and Bayley MDI Scores at 12 and 18 months [3]

	12 months Bayley MDI	18 months Bayley MDI
12 months		
Spontaneous Mastery	.54 ***	.48 ***
Executive Capacity	-.31 *	-.23

	12 months Bayley MDI	18 months Bayley MDI
18 months		
Spontaneous Mastery	.31 *	.46 **
Executive Capacity	-.18	-.12

* p= .05
** p= .01
*** p= .001

3 Bayley MDI scores at 12 months correlated significantly with Bayley MDI scores at 18 months (r= .50, p= .001).

Table 2

Means and Standard Deviations of Dependent Variables by Cultural Group

Dependent Variable	Cultural Group: Pennsylvania		Bermuda		F ratio	
	X	SD	X	SD	df= 1,36	p<
At 12 months						
Spontaneous Mastery	74.85	(32.88)	50.11	(41.34)	1.53	NS
Executive Capacity	1.80	(1.15)	1.17	(3.28)	8.09	.01
Bayley MDI	122.50	(12.80)	116.67	(13.02)	1.03	NS
Undifferentiated play	56.05	(23.11)	33.00	(10.55)	4.80	.05
Transitional Play	31.20	(15.06)	10.61	(7.25)	4.32	.05
Pretend play	3.65	(4.68)	6.39	(6.87)	2.15	NS
At 18 months						
Spontaneous Mastery	162.65	(62.24)	95.89	(38.88)	2.56	NS
Executive Capacity	1.60	(1.70)	2.61	(2.00)	1.39	NS
Bayley MDI	132.05	(13.72)	112.11	(19.38)	1.99	NS
Undifferentiated play	37.85	(9.39)	17.00	(9.37)	1.00	NS
Transitional play	35.85	(8.43)	21.83	(10.08)	1.43	NS
Pretend play	17.45	(10.84)	11.22	(7.39)	1.88	NS

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